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BUREAU OF SOILS—BULLETIN No. 37.
MILTON WHITNEY, Chief.

# EXPERIMENTS IN GROWING CUBAN SEED TOBACCO IN ALABAMA.

BY

GEORGE T. McNESS AND LEWIS W. AYER.

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Wm. B. Schrader.

# LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Soils,
*Washington, D. C., October 9, 1906.*

Sir: I have the honor to submit the accompanying manuscript report on the work of introducing the production of Cuban seed tobacco into central Alabama. The report shows the progress of the work during the three years that experiments have been carried on in this State. On the whole the results are very gratifying, and seem to indicate the ultimate establishing of a profitable tobacco industry in this part of the country. I would recommend the publication of this report as Bulletin 37 of the Bureau of Soils.

Very respectfully,

Milton Whitney,
*Chief of Bureau.*

Hon. James Wilson,
*Secretary of Agriculture.*

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# EXPERIMENTS IN GROWING CUBAN SEED TOBACCO IN ALABAMA.

## INTRODUCTION.

Alabama has never been recognized as a tobacco-producing State. altho the climate and certain soils in different parts of the State are well adapted to its culture. Prior to 1903 tobacco was grown only for home use. This was usually cured by sun and air and used almost entirely for pipe smoking. A very small part of it was stript and made into twist for chewing, but the manufacture was of the crudest character. The plant was grown in all but three counties, the yield averaging between 200 and 300 pounds to the acre, which in itself indicates careless cultivation. Before 1879 more than one-third of all the tobacco produced in the State was grown in the eight counties lying along the Tennessee River. The crop of these counties, grown on 757 acres, yielded about 163,246 pounds, and was mainly consumed at home. At the present time small patches of tobacco can be found scattered all over the State, but no attempts have been made to build up a tobacco industry.

In 1902 the Bureau of Soils made a soil survey of Perry County and in 1904 of Dallas County and found in these counties soils resembling the Partidos soil of Cuba and similar also to soils in east Texas and Florida, where Cuban seed tobacco is being successfully grown. Later it was decided to extend the tobacco experiments in growing Cuban leaf tobacco to this section, and the present bulletin describes the progress of the work there.

## CLIMATE.

In climate central Alabama is typical of a large part of the Gulf States. The winters are mild, with an occasional cold spell which seldom lasts longer than three days. The growing season is long, but the heat of summer is not so great as in some more northern interior sections, and the temperature seldom rises above 100° F. The average date of the first killing frost falls in the second week in November, while the last killing frost in spring occurs about the middle of March.

*Normal monthly and annual temperature and precipitation in central Alabama.*

| Month. | Selma. |  | Marion. |  | Uniontown. |  |
|---|---|---|---|---|---|---|
|  | Temperature. | Precipitation. | Temperature. | Precipitation. | Temperature. | Precipitation. |
|  | *° F.* | *Inches.* | *° F.* | *Inches.* | *° F.* | *Inches.* |
| January | 40.0 | 4.58 | 47.7 | 3.95 | 47.1 | 4.75 |
| February | 47.8 | 6.28 | 47.0 | 5.86 | 48.2 | 6.44 |
| March | 58.1 | 7.37 | 55.9 | 4.62 | 56.3 | 5.35 |
| April | 63.6 | 4.44 | 65.5 | 3.50 | 65.8 | 3.95 |
| May | 72.3 | 2.65 | 72.6 | 3.03 | 73.5 | 4.00 |
| June | 78.9 | 4.23 | 79.3 | 3.73 | 80.1 | 4.45 |
| July | 81.4 | 4.67 | 80.7 | 4.89 | 81.7 | 5.47 |
| August | 80.6 | 5.65 | 80.6 | 4.88 | 80.8 | 4.75 |
| September | 76.0 | 2.04 | 75.4 | 3.08 | 76.6 | 2.50 |
| October | 66.4 | 2.15 | 65.5 | 2.63 | 67.0 | 2.01 |
| November | 54.8 | 3.22 | 55.0 | 3.04 | 56.0 | 3.10 |
| December | 47.3 | 4.44 | 48.2 | 4.24 | 50.3 | 3.88 |
| Year | 63.9 | 51.72 | 64.4 | 47.45 | 65.3 | 50.65 |

The data given in the foregoing table are fairly representative of the conditions as regards the temperature and rainfall of the region within which the experiments were carried on. A table giving the actual rainfall for 1904 and 1905 on the experimental field will be given later. But before leaving the question of general climatic features it will be interesting to compare the figures given above for the months of the growing season with similar data for Habana, Cuba, to see if there are any broad differences that might indicate the impracticability of approximating a Cuban type of leaf.

*Comparative table of temperature and precipitation for six months of growing season in Alabama and Cuba.*

| Alabama. |  |  |  |  | Habana, Cuba. |  |  |
|---|---|---|---|---|---|---|---|
| Month. | Selma. |  | Marion. |  | Month. | Temperature. | Precipitation. |
|  | Temperature. | Precipitation. | Temperature. | Precipitation. |  |  |  |
|  | *° F.* | *Inches.* | *° F.* | *Inches.* |  | *° F.* | *Inches.* |
| April | 63.6 | 4.44 | 65.5 | 3.50 | October | 78.1 | 8.49 |
| May | 72.3 | 2.65 | 72.6 | 3.03 | November | 75.3 | 4.24 |
| June | 78.9 | 4.23 | 79.3 | 3.73 | December | 71.4 | 1.93 |
| July | 81.4 | 4.67 | 80.7 | 4.89 | January | 70.3 | 2.32 |
| August | 80.6 | 5.65 | 80.6 | 4.88 | February | 72.0 | 2.52 |
| September | 76.0 | 2.04 | 75.4 | 3.08 | March | 73.2 | 2.50 |
| Six months | 75.5 | 23.68 | 75.7 | 23.11 | Six months | 73.4 | 22.00 |

Regarding the averages for the six months, there is seen to be a close correspondence between the figures for Selma and Marion and those for Habana. Examined month by month, there are differences which may have considerable effect in differentiating the character of the leaf. At Habana the temperature is equable, the extremes being only 8° F. apart, while at Selma there is a range of 18° F. and at Marion 15° F. At Habana the rainfall is very much heavier during the first two months of the period and very much less for the remainder of the growing season.

As no records of relative humidity have been kept at Selma and Marion, the following table is given to afford a comparison of the mean monthly relative humidity for the growing season as recorded at Montgomery, Ala., which is probably representative of the area under consideration, and at Habana.

*Mean monthly relative humidity at Montgomery, Ala., and Habana, Cuba.*

| Montgomery. | | | Habana. | |
|---|---|---|---|---|
| Month. | 8 a. m. | 8 p. m. | Month. | Mean. |
| April | 86 | 61 | October | 78 |
| May | 88 | 69 | November | 77 |
| June | 81 | 64 | December | 73 |
| July | 87 | 66 | January | 76 |
| August | 90 | 74 | February | 73 |
| September | 87 | 64 | March | 71 |

Turning now to local conditions during the period the experiments were conducted, it will be noticed that during the early part of the season the climatic conditions were unfavorable, dry weather and hot winds seriously retarding the growth of the plants, altho later the climatic conditions were favorable to the maturing of the tobacco. The following table shows the precipitation during the growing seasons of 1904 and 1905 upon the experimental field at Marion:

*Precipitation during growing season at Marion, Ala.*

| Date. | Precipitation. | Date. | Precipitation. | Date. | Precipitation. | Date. | Precipitation. |
|---|---|---|---|---|---|---|---|
| 1904. | *Inches.* | 1904. | *Inches.* | 1905. | *Inches.* | 1905. | *Inches.* |
| Apr. 26 | 0.25 | July 27 | 0.15 | May 8 | 0.62 | July 25 | 0.10 |
| May 7 | .32 | 28 | .64 | 14 | .19 | 28 | 1.10 |
| 13 | .22 | 29 | 1.55 | 15 | 1.68 | 29 | .10 |
| 16 | .53 | Aug. 1 | .61 | 16 | .27 | 30 | .50 |
| 27 | .75 | 3 | .20 | 21 | .71 | Aug. 1 | .80 |
| 30 | .65 | 6 | .20 | 22 | .31 | 2 | .50 |
| June 6 | .50 | 7 | 1.05 | 23 | .12 | 7 | .55 |
| 8 | .31 | 9 | .35 | 30 | .11 | 9 | .35 |
| 22 | .71 | 10 | 1.03 | June 13 | .15 | 10 | .10 |
| July 3 | 1.31 | 11 | .20 | 17 | .29 | 11 | .60 |
| 5 | .91 | | | 18 | .69 | 12 | .40 |
| 6 | .10 | 1905. | | 21 | .09 | 13 | .10 |
| 7 | .03 | Apr. 3 | .21 | 22 | .10 | 14 | .35 |
| 9 | .31 | 4 | .13 | 26 | 1.05 | 15 | .40 |
| 11 | .11 | 5 | .14 | 29 | .90 | 16 | .44 |
| 17 | 1.31 | 15 | 1.06 | July 4 | .30 | 18 | .40 |
| 19 | .05 | 25 | 1.05 | 9 | .46 | 19 | .40 |
| 21 | .82 | 26 | .23 | 17 | .15 | 22 | .43 |
| 22 | .75 | 29 | .05 | 21 | .14 | | |
| 23 | 2.21 | 30 | .07 | 23 | 1.28 | | |
| 26 | .22 | May 7 | .07 | 24 | .30 | | |

## SOILS.

Of the various types of soils to be found in the Southern States those of the Orangeburg series are best adapted for the production of both cigar wrapper and filler tobacco. The two soils of this series used in the experiments in central Alabama are the Orangeburg fine sandy loam and the Orangeburg clay.

### ORANGEBURG FINE SANDY LOAM.

The surface soil of the Orangeburg fine sandy loam consists of a gray to reddish fine sandy loam, with a depth of 15 inches, overlying a red sandy clay. This soil frequently contains small iron concretions and at times bands of fine gravel. It is one of the widely distributed soils of this part of the State. It varies in topography from rolling to quite hilly, and the drainage is good. In places the type shows decided erosion, and where the washing is developed with some uniformity over sufficient territory the soil grades into the Orangeburg clay. The Orangeburg fine sandy loam is derived from the sands and clays of the Lafayette mantle and is one of the characteristic soil products of this geological horizon. The Lafayette formation has been subjected to great erosion since its elevation above water, resulting in the very uneven surface features now found. Sandy ridges vary with gravel-capped hills, while in many directions the small streams have developed their miniature valley systems often to a surprizing degree. Much of this soil is still in forest, composed of a fair, mixt growth of pine, hickory, black oak, and red oak, in which lumbering is occasionally conducted. The gravel-capped hills and ridges must be separated as the gravelly phase of this type.

The following table gives the average results of mechanical analyses of samples of the Orangeburg fine sandy loam:

*Mechanical analyses of Orangeburg fine sandy loam.*

| Number. | Description. | Fine gravel. | Coarse sand. | Medium sand. | Fine sand. | Very fine sand. | Silt. | Clay. |
|---|---|---|---|---|---|---|---|---|
| | | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* |
| 12700, 12702.. | Soil | 1.3 | 12.2 | 12.1 | 36.7 | 16.1 | 14.5 | 6.3 |
| 12701, 12703.. | Subsoil | .3 | 5.8 | 7.6 | 25.2 | 12.5 | 18.4 | 29.3 |

### ORANGEBURG CLAY.

The Orangeburg clay consists of a dark-red, heavy, sandy loam, of a depth not exceeding 4 inches, overlying a red, sandy clay subsoil. In cultivated areas the transition between the soil and subsoil is more gradual owing to the effects of plowing and high bedding. The soil occurs in the more elevated parts of the uplands in both Perry and Dallas counties. Its topography is at times very hilly, but there are frequently to be found high but fairly level areas which make very good farming lands. The occurrence of such level tracts in the most elevated parts of the uplands indicates that the present crests of the hills and ridges were once the plane of an extensive and uniformly level peneplain, and these hilltops and ridges are the results of excessive erosion upon such a peneplain and by no means due to any process of violent uplift. The soil is well drained, and in the hillier areas must be protected from washing.

The Orangeburg clay owes its origin to marked erosion of the Lafayette sands and clays in the uplands and is developed where the sandy surface soil is measurably removed from such soils, as the Orangeburg fine sand and the Orangeburg fine sandy loam.

The tracts of Orangeburg clay are very generally cleared in this region, the native growth being mostly hardwood. It is said, however, that while crops produce more on this soil in good seasons than on the sandier types, they are likely to suffer from drought even more than on the sandy types. The soil has naturally a higher moisture capacity than the sandier soils, and its liability to drought must be traced to the fact that it is plowed too shallow. This shallow plowing is not so prejudicial on the sandy soils, because there is always a considerable sandy root zone before the clay is reached. But on this clay soil, unless plowed deep, the crops are unable to develop a sufficiently deep root system in the unbroken clay, and the surface roots suffer as soon as the shallow-tilled surface dries out.

The average results of mechanical analyses of samples of the Orangeburg clay are given in the following table:

*Mechanical analyses of Orangeburg clay.*

| Number. | Description. | Fine gravel. | Coarse sand. | Medium sand. | Fine sand. | Very fine sand. | Silt. | Clay. |
|---|---|---|---|---|---|---|---|---|
| | | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* |
| 12706, 12704 | Soil | 0.0 | 1.4 | 6.3 | 38.7 | 4.3 | 19.1 | 29.7 |
| 12707, 12705 | Subsoil | Tr. | 1.1 | 5.2 | 29.5 | 3.7 | 16.5 | 43.7 |

## EXPERIMENT OF 1903.

The experiments in Alabama were begun in the spring of 1903. Arrangements were made with Mr. C. H. Greer, of Marion, for the use of 3 acres of land—1 acre of the Orangeburg fine sandy loam and 2 acres of the Orangeburg clay—barns, etc., under the following agreement:

1. All the necessary land and shed room for 3 acres shall be donated free of charge by the owner.

2. The Department of Agriculture shall provide and pay for such fertilizer or manure in quantity and kind as may be needed; shall prepare the land, plant the crop, and cultivate and harvest the same.

3. The Department of Agriculture shall furnish teams and tools at such times as may be necessary for the cultivation and care of the crops.

4. The Department of Agriculture shall have entire control of the production and handling of the tobacco in such warehouses and such places as may seem desirable, and shall in no way be hampered or interfered with by the wishes or views of the owner.

5. In case the experiment is a success and a desirable type of Cuban filler leaf is produced, in order to get a free and reliable opinion of the commercial

value of such leaf and for the purpose of establishing a market therefor, the Department reserves the right to retain for free distribution to dealers and manufacturers any amount up to 50 per cent of the crop without compensation to the owner. It is further agreed that a person selected by the Chief of the Bureau of Soils will be designated as the owner's agent to sell on the most favorable terms possible the remainder of the tobacco and deliver the gross proceeds to the owner of the land, it being clearly recognized that the crop belongs to the owner and not to the Department, the Department merely acting as an agent in a cooperative experiment to demonstrate to the people of Alabama that a high quality of Cuban seed filler leaf can be produced on a certain soil found in the course of the soil survey and to secure reliable and accurate information as to the value placed on this product by leaf dealers and cigar manufacturers.

The field on which this experiment was conducted was situated on the outskirts of Marion and contained two types of soil—the Orangeburg clay and the Orangeburg fine sandy loam. The surface of the land was rolling; in fact, a hillside. In the upper part the soil was loamy, while on the steeper slopes it contained more clay, owing to the partial washing away of the top soil, altho the land had been terraced to prevent this washing. Altho a small plant bed was made, owing to the lateness of the season it was found impossible to produce enough plants at Marion for this experiment, so that most of the plants used were shipped by express from the Bureau's experiment station at Nacogdoches, Tex. These were transplanted to the field as they arrived.

About March 27 the soil was prepared by breaking it broadcast to a depth of 6 inches. A deeper plowing would have been better, but owing to the compactness of the soil it was almost impossible to prepare the land deeper. After plowing a wooden drag or clod breaker was used, as on the part of the field containing the most clay the plow left many clods, and in order that the field should be in the best mechanical condition it was necessary that these should be broken up. Well-rotted stable manure was procured from the local livery stable and this was applied broadcast on the land at the rate of 10 two-horse loads to the acre. Stable manure was used in preference to commercial fertilizer because of the lack of humus in the soil. This was plowed under and the land allowed to lie in this condition until the middle of April, when the soil was bedded up in rows 3 feet apart. During the time the land was being prepared the weather was very dry and some difficulty was experienced in getting the soil in good condition.

On April 18 there was a good rain, and transplanting was commenced on the Orangeburg fine sandy loam, but about April 25 the weather again became cool and dry, which conditions were bad for the young plants set in the field. The cutworms also caused some trouble, necessitating considerable resetting. Transplanting and resetting were continued until May 9, on which date the entire 3 acres had been set and a good stand obtained. The tobacco on the upper part of the field, or the Orangeburg fine sandy loam, made a good growth, but that planted on the Orangeburg clay started growing very slowly. On May 16 there were experienced some very heavy rains, and on the clay land about 3,000 plants were lost by drowning. These were reset as soon as the climatic conditions became favorable. From this time until June 13 the weather conditions were favorable, with the exception of a slight hail storm on May 30, which, however, did very little actual injury to the crop. The tobacco on the loamy soil continued to make good growth, and on June 6 it had reached the height of 4 feet (see Pl. I), while that planted on the clay soil seemed to be stunted and some of the plants had budded. About June 20 there occurred a period of drought, and some parts of the crop began to fire at the bottom of the stalk; but on June 27 there was another rain and the tobacco seemed to take on a fresh growth, the condition of the crop over the entire field being promising, and especially so on the Orangeburg fine sandy loam, where about 1 acre of the tobacco was 5 feet high.

Harvesting was commenced the latter part of June, when the tobacco that was first planted was cut and hung in the barn to cure. About July 16 it began to rain, and continued showery for ten days, which necessitated the placing of fires in the barn to prevent the tobacco becoming damaged from pole sweat and mold. By July 19 all of the crop was hung in the barn. From this time on the climatic conditions were favorable, there being alternate damp and dry periods, which greatly facilitated the curing of the leaf. On July 27 the tobacco that was first hung in the barn was taken from the poles and stript, and this work continued until August 1, by which time all the crop had been stript and packed in boxes ready for shipment to Nacogdoches, Tex., where it went thru the process of fermentation in the Bureau's warehouse. The 3 acres yielded 1,305 pounds of cured tobacco, or an average of 435 pounds of merchantable tobacco to the acre.

## EXPERIMENT OF 1904.

Owing to the abnormal season of 1903, when drought toward the time of harvest prevented the tobacco from ripening properly, and because of the marked effects of climate on the quality of tobacco, it was not considered fair to draw final conclusions regarding the adaptability of Perry County soil and climate to the production of a Cuban seed filler from that season's experiment. Therefore arrangements were made with Mr. John Sprott for leasing 1½ acres of Orangeburg fine sandy loam and 1½ acres of Orangeburg clay, together with facilities for curing the tobacco. Teams and tools were also furnished the Bureau by Mr. Sprott at reasonable prices. The two fields on which this experiment was conducted lie some 7 miles east of Marion, across the Cahaba River. The Orangeburg fine sandy loam field is situated in what is known as the second bottoms and the previous year had been planted in corn followed by cowpeas. The Orangeburg clay field was situated on the top of a hill, of which there are many in this locality, and had for several years prior to 1904 been farmed by tenants, who used it for cotton. Consequently the field was pretty well depleted of vegetable matter and not in such good mechanical condition as the Orangeburg fine sandy loam field. These distinct types of the Orangeburg series were selected to make possible a further comparison of their relative merits in the culture of tobacco. The results of the previous year's experiment were clearly in favor of the loamy soil, which stood the extremes of the weather better than the clay soil, besides responding more readily to fertilization; but the test in that year, owing to shallow plowing of the clay soil and the unfavorable season, was not considered definitive.

## PREPARATION OF SEED BED.

The preparation of the seed bed was begun on February 2 by cutting the wood necessary for burning the bed, but on account of the unfavorable weather conditions the actual burning of the bed was not commenced until February 11. This was performed by placing poles across the bed. Upon these poles was placed the cord wood and brush which formed the fire. This was allowed to burn until the soil had become heated several inches deep, when it was drawn over another section of the bed, fresh brush and wood being continually placed upon the fire, so as to form a good bed of ashes upon the burned land. This operation of dragging the fire was repeated until the entire surface of the bed had been treated. The bed was then allowed to cool off, and before the ashes from the fire could be blown away by the wind or washt off by the rain the bed was dug up and all the large roots removed. After this work had been performed a fine-toothed rake was used to remove all the fine roots and trash, thus leaving the bed in a fine pulverulent condition. Cotton-seed meal was then applied broadcast at the rate of 100 pounds for the 242 square yards of the bed. This was worked into the surface of the soil and the bed was raked and leveled off again, thus leaving it in the best possible condition for receiving the seed.

Poles were then placed around the bed and made secure by stakes, earth being drawn up to the poles on the outside so as to prevent washing of the bed in the case of heavy rains. For the convenience of the laborers when watering or weeding had to be done, the bed was divided into three sections.

The seed was sown on February 18 at the rate of a tablespoonful to every 10 square yards of bed. Seed imported from the Vuelta Abajo district of Cuba was used, and after being sown was lightly covered and watered. The entire bed was then covered with cheese cloth as a protection against insects and heavy rains. During dry weather the bed was watered every morning and when necessary weeded and poisoned, and by April 21 the plants were large enough to transplant.

## PREPARATION OF LAND.

In preparing the soil (Orangeburg clay) on the Sprott hill a "scooter" plow was used to loosen the soil on each side of the old cotton stalks, this field having the previous year been planted to cotton. The stalks were then pulled up and placed in piles and burned. Owing to the lack of organic matter and the compactness of the soil, it was deemed advisable to plow the land with a long "scooter" plow, as a hardpan or plow sole had been formed about 4 inches under the soil thru continued shallow plowing. The land was plowed in both directions and to a depth of 8 inches. Still deeper plowing would have been better, but owing to the condition of the soil it was impossible with the tools available. A furrow was then laid off every 3 feet, and in this furrow were placed 500 pounds of cotton-seed meal and 500 pounds of cotton-seed hulls per acre. This was thoroly incorporated with the soil, after which two shallow furrows were turned on it, thus forming a ridge or small flat bed upon which the plants were to be set.

The Orangeburg fine sandy loam field was found to be in a much better mechanical condition than the clay field. The former had been in corn and cowpeas the previous year, and in the fall the cornstalks and cowpea stubble had been plowed under with a 2-horse turn plow, thus adding considerable humus as well as about 40 pounds of nitrogen to the acre, furnished by the cowpea stubble. Most of this vegetable matter had decayed during the winter. A few of the cornstalks remained, and as these would be a considerable hindrance in the cultivation of tobacco they were gathered and burned. The soil in this field being a sandy loam, underlain by a clay at a depth of about 14 inches, it was much easier to prepare than the other. The field was bedded, four furrows to a row, with a 1-horse plow. Into the furrow thus formed was placed the same amount of fertilizer as was used on the Sprott hill field. This was thoroly mixt with the soil with a round-shovel plow and two turn furrows placed upon it, thus forming a slight ridge. In this condition both fields were left until the plants were large enough to transplant.

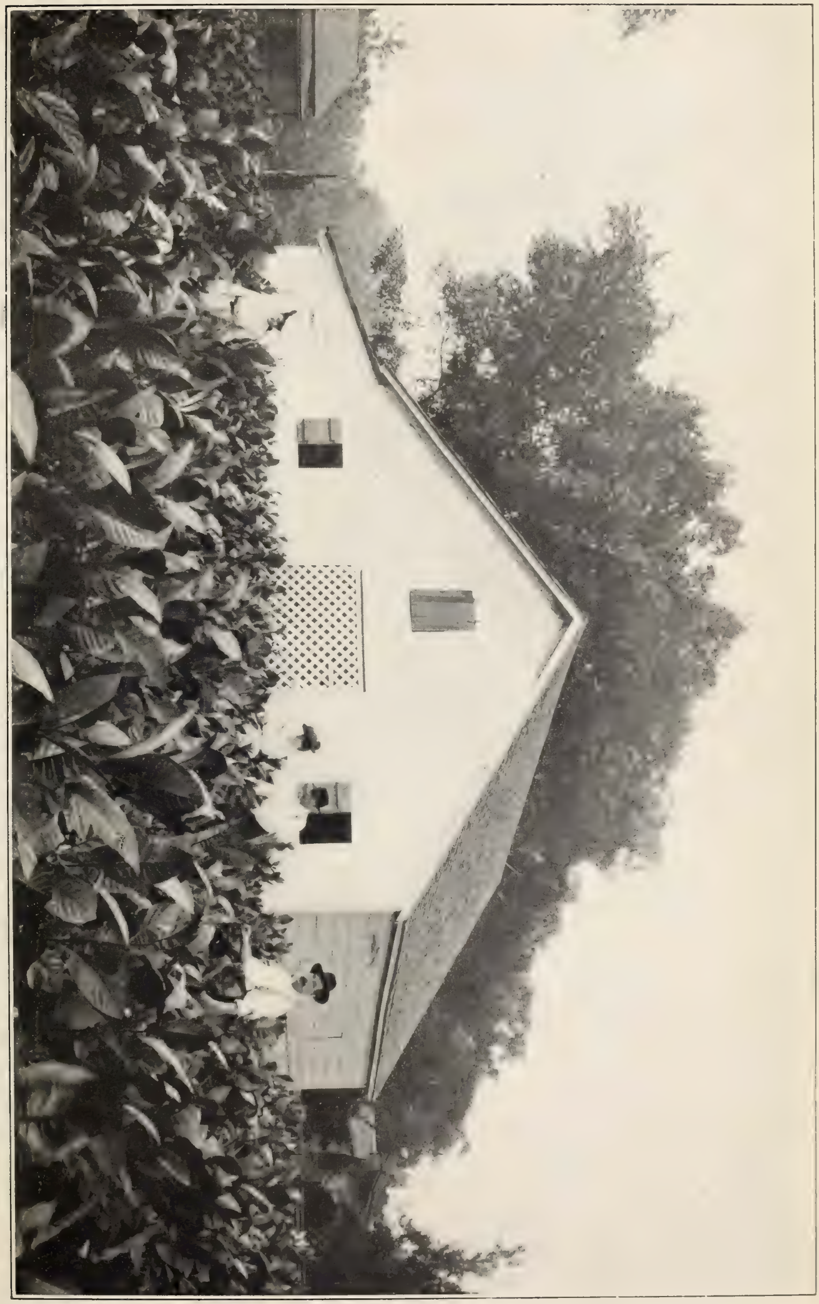
### TRANSPLANTING.

Several days before transplanting the young plants from the bed into the field, the cloth was taken off the bed for the purpose of hardening the plants so they would be better able to withstand the heat of the sun after being set out. Transplanting was begun in the Orangeburg fine sandy loam field on April 21 and in the Orangeburg clay field on May 9, the entire crop of 3 acres being set out by May 13. Owing to the dryness of the weather at this period, great care had to be exercised both in pulling the plants from the bed and in transplanting them in the field. The bed was first saturated with water, so that the plants could be pulled with as little damage to the roots as possible. They were then placed in small boxes and conveyed to the field, where the following method was used in planting: Holes were dug in the bed every 10 inches, and into each of these about one-half pint of water was poured. The plant was set in the moist soil, dry soil was drawn about it, and the whole prest firmly about the roots. This method of planting, altho rather tedious, gave very satisfactory results, as the dry soil prevented any baking of the surface around the plant and also retarded the evaporation of moisture.

In most of the older producing States tobacco is set by a machine. Three men are required to operate it, one to drive and two to feed the plants. It not only opens the furrow, but waters and covers the plants at the same time. From 3 to 5 acres can be transplanted in a day with one of these tobacco setters, and as a rule better results can be obtained than where hand setting is practised. Tobacco set by a machine has been known to grow and produce a fine crop, when the climatic conditions would have been fatal to hand-set tobacco. As the industry extends in Alabama and larger acreages are planted by the individual farmers, there is no doubt that machine setting will supplant the present method of setting tobacco.

### CULTIVATION AND PROTECTION AGAINST INSECTS.

About ten days after the plants were set in the field they were given their first cultivation. Hand hoes were used, breaking the crust which had formed upon the bed and placing fresh moist soil around each plant. Three hand hoeings were given the crops in both fields, after which wing sweeps were used entirely. While the plants were small a 12-inch wing sweep was used for the siding furrows and an 18-inch wing sweep to plow out the middles, but after the plants were larger an 18-inch wing sweep was used for both siding and middle breaking. Both fields were kept clean of grass and weeds and the last cultivation was given each field just after the plants were topt, leaving the tobacco on a rounded bed, with a furrow between the rows deep enough to carry off the water after heavy rains. Shal-



CUBAN SEED TOBACCO ON ORANGEBURG FINE SANDY LOAM, MARION, ALA.

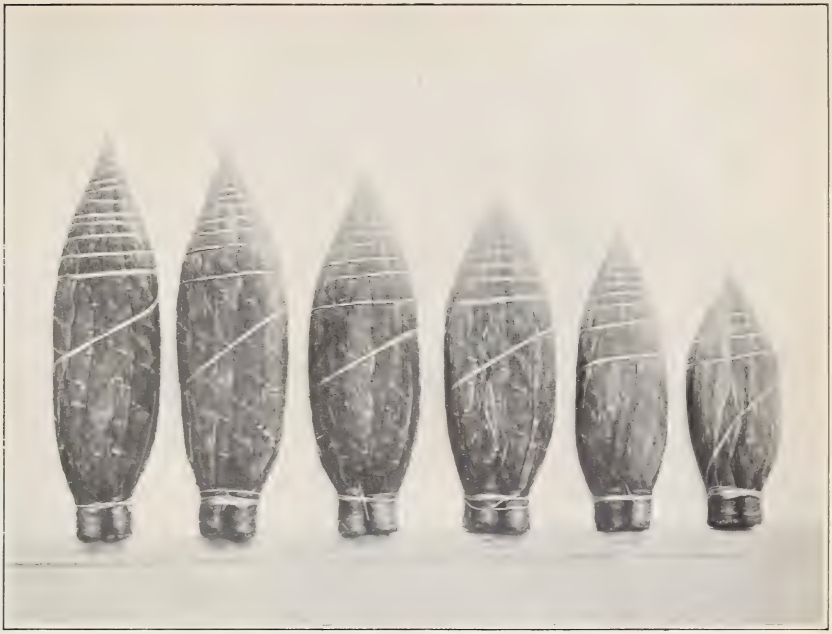


FIG. 1.—CARROTS OF ALABAMA CUBAN FILLER.

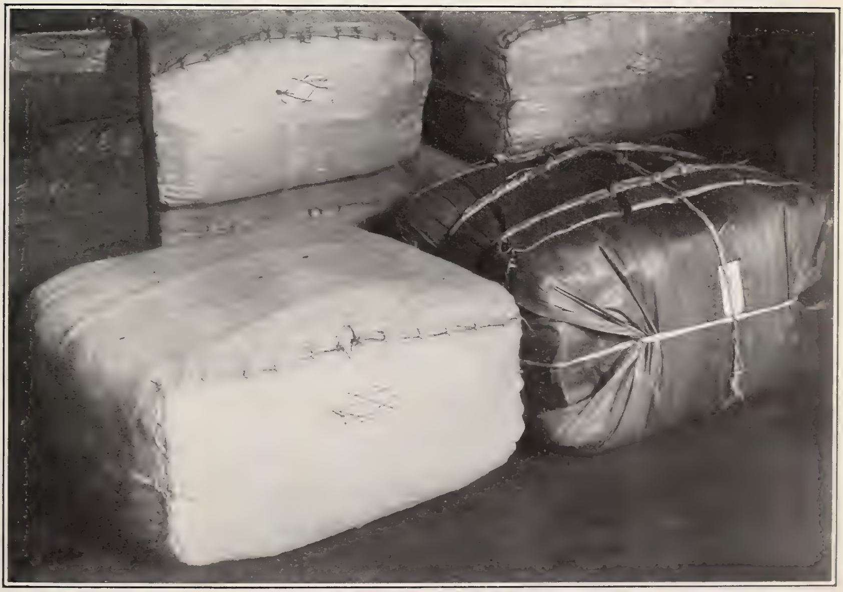


FIG. 2.—BALES OF ALABAMA CUBAN FILLER.

low and thoro cultivation was practised at all times, care being taken not to disturb the roots of the plants. In cultivating tobacco it is necessary that the crop should be plowed with a shallow cultivating implement, such as a wing sweep or cultivator.

A light mulch should always be kept upon the surface of the soil to prevent the rapid evaporation of moisture that occurs if the soil is left for any length of time without being stirred. It is a frequent mistake among tobacco farmers, even in some of the older tobacco-producing States, to give their tobacco crop a certain number of workings and then " lay it by " the same as they would corn or any hardier crop. They need not be surprized if maximum yields are not secured with this method. Cultivation should be given the crop at least once a week, and after each heavy rain, just as soon as the condition of the soil will permit.

Several kinds of insects were encountered during the various stages of the plant's growth. Just after transplanting cutworms gave some trouble, making it necessary to reset a portion of the field. These were overcome by using paris green mixt with middlings or corn meal. A mixture of paris green was also used to combat the ravages of the bud worm, and when the horn worm appeared the crop was sprayed every two weeks with a mixture consisting of 1 pound of paris green, 1 pound of lime, and 125 gallons of water.[a] By constant watching and the prompt application of the proper remedy, insect pests were kept under control.

## TOPPING, SUCKERING, AND HARVESTING.

The flower bud appeared from seven to eight weeks after setting out the plants. These, together with several of the top leaves, were taken out, care being exercised that no damage was done to the rest of the plant. According to the vitality of the plant, from fourteen to sixteen leaves were left to mature, and in no instance, except where the plant was selected for the production of seed, was the flower bud left. No definite rule can be laid down as to how many leaves should be taken off with the bud, as the climatic conditions during the growing season, the purpose for which the plant is grown—whether for wrapper or filler leaf—its vitality, and general character must determine how low or high the topping should be done.

After the plants were topt suckers appeared at the junction of the leaves with the stalk. These were also taken out when large enough to be removed without injury to the plant. In all, the crop was suckered three times. A few plants suckered freely before the top was taken out, which is characteristic of Cuban tobacco. These suckers were also removed as soon as they became an inch long. Suckers will appear on all types of tobacco after it is topt, and unless they are removed the quality of the leaf will be affected.

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[a] This mixture is recommended by the Bureau of Entomology. For information on tobacco insects and means of control see Farmers' Bulletin No. 120, The Principal Insects Affecting the Tobacco Plant, by L. O. Howard, Entomologist, U. S. Department of Agriculture.

Harvesting was commenced about July 8, when the first settings were ripe.[a] Owing to the unfavorable weather conditions (there being a considerable number of rainy days) and to the irregularity of ripening on account of the different settings, harvesting was not concluded until August 5.

In harvesting the crop the following methods were used: As soon as the dew was off the leaves the tobacco was cut about 2 inches above the ground with a sickle. It was then laid carefully on the ground to wilt, care being taken not to break any of the leaves. After wilting sufficiently to be handled without breakage it was placed upon a stretcher and carried to a bench erected in a shady part of the field and there speared upon laths 4 feet long. From eight to twelve plants, according to their size, were placed upon each lath, a sufficient distance being left between plants to allow a free circulation of air when placed in the barn. After spearing the plants were hung upon a scaffold to wilt still further. Whenever enough tobacco had been speared to fill the wagon it was hauled to the curing barn. In hauling the tobacco a special rack was built upon the wagon, whereby the laths of tobacco hung in a position similar to that they occupied on the scaffold. This method prevented the breaking and bruising of the plants during transportation from the field to the barn.

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[a] The time when a plant of tobacco is ripe and ready to be cut is a matter of judgment and experience. There is a slight change in the color of the leaf. The leaf is observed to change from a rank green to a lighter shade of green, yellow spots appear, and the leaf feels coarse and thick to the touch. It also breaks easily, especially when the dew is upon it. Doctor Loew, in his Physical Studies of Connecticut Leaf Tobacco, states that the ripening of the leaf is not a physiological but a pathological phenomenon. By the accumulation of nicotine oxidizing enzyms and acids a state is finally reached in which the normal deep-green color of the chlorophyll grains gives way to a yellowish color. A ripe leaf contains per 100 square centimeters an average of 0.164 gram of matter soluble in running water, while a young leaf contains only 0.066, the former having therefore for an equal surface about 2.5 times as much soluble organic matter as the latter. As to the total weight, the ripe leaf weighs from 1.3 to 1.5—on the average 1.4—times as much as an equal surface of a young leaf of the same plant. It is especially the nicotine and the protein compounds that increase in a ripe leaf, a fact of which anyone can soon convince himself by a comparison of the reaction caused by phospho-tungstic acid in the juices of ripe and unripe leaves. The amount of water in ripe leaves averages 83 per cent and in a young leaf 88 per cent: that is, when compared in nearly starch-free condition after being kept two days in darkness. As to the so-called "overripe" leaves, they contain, like the young leaves, relatively more water and less organic matter than the ripe leaves. By the stoppage of the function of the chlorophyll grains, which gradually change in the overripe leaves, new production of organic matter is prevented while consumption proceeds.

### MANAGEMENT OF THE CURING BARN.

Owing to the absence of suitable barns for curing, this part of the experiment was conducted under great disadvantages. The only building available that was at all adapted for the purpose was an old-fashioned gin house. This building had to be repaired and the necessary tier poles and other interior fittings provided. Even then it was found impossible to control the atmosphere and moisture conditions. The tobacco was hung upon the tier poles as soon as received from the field, about 4 inches of space being left between laths in the upper part of the building to prevent a too rapid cure, while in the body of the barn more space was given between laths to allow for a free circulation of air, which in the case of damp, rainy weather prevents to some extent damage from pole sweat.

About the second week in August, shortly after the tobacco had been harvested, there was a period of rainy weather which made it necessary to build small wood fires in the barn. In regular tobacco barns these fires are built upon the dirt floor, but as this building was two stories high and had wooden floors, it was necessary to make small shallow boxes about 3 feet square. These were filled with sand and upon this the fires were built. This firing was continued every day during the rainy period, the tobacco being thoroly dried out once every twenty-four hours. In this way a good deal of damage from pole sweat and mold was avoided, altho, owing to the lack of conveniences and the necessity of building small fires (larger ones would have been dangerous), a small proportion of the crop in the lower part of the building was slightly damaged. As climatic conditions and the character of the tobacco determine to a large extent the methods to be used in manipulating a barn, it is impossible to lay down definite rules of procedure, but in a general way the method is as follows:

When the weather is hot and dry the barn is kept closed during the day and opened at night. This allows the tobacco to become soft and pliable in the night, as during the curing season in the South there is generally considerable moisture in the atmosphere during the night; but whenever the weather is rainy and a strong wind is blowing, it is best to keep the barn closed tight at night as well as during the day, either to prevent damage from the excess of moisture or to guard against injury to the leaf by whipping. During a continued period of wet and cloudy weather it is always advisable to keep the barn closed and to keep small wood or charcoal fires burning thruout the barn long enough to dry out the tobacco once a day. These fires should be continued as long as is necessary to keep the tobacco in proper condition. When charcoal is not available, wood that has as little odor as possible should be used, as it is important when curing cigar tobacco to avoid giving the leaf any foreign odor. The barn curing is completed when the midribs of the leaves are cured, at which time the tobacco is ready to be taken down. To get the tobacco in condition to be handled, all the ventilators must be left open the night before. In the morning the tobacco should be soft and pliable, but not wet, and the ventilators should be closed to retain the moisture. When tobacco is cured on the stalk, as in Alabama, four or five weeks in the barn will produce a good cure; but whether it can be stript as soon as cured depends entirely on the climatic conditions.

### STRIPPING AND TYING.

During the first damp weather after the tobacco had been thoroly cured, which occurred on August 29, a portion of the crop was taken from the tier poles and stript, the barn having been left open the night before to allow a free circulation of moist air, which puts the tobacco in good "kase." This damp season was of short duration, and there was not time to strip the entire crop. From this date up to September 19 there was a continuance of dry weather, but on this date a slight fog brought the tobacco on the lower tiers in "order," and 680 pounds were stript from the poles. The weather again turned cool and dry and no more tobacco could be taken down until October 17, when 200 laths of tobacco were brought into order and stript by hanging them in an open shed and saturating the dirt floor with water. On November 2 there was a good rain which brought the remaining tobacco in order, and by November 8 the entire crop had been stript and graded, three grades being made, namely, sand leaves, middles, and tops. The grading was done so that the tobacco could be better handled in the warehouse, as leaves from different parts of the plant, owing to their different character, require different treatment in the fermenting process. The tobacco was then tied into hands containing from forty to fifty leaves and packed in boxes for shipment to the Bureau's warehouse at Nacogdoches, Tex., where it went thru the fermentation and final assorting.

### FERMENTATION.

The 680 pounds of tobacco that was shipped from Alabama the latter part of September was placed in bulk at Nacogdoches on October 20, and the remainder of the crop—700 pounds—was bulked in November. In fermenting this tobacco the following method was used: To support the bulk a platform was made, 5 feet wide and 12 feet long, raised about 4 inches from the floor of the fermenting room. At the ends of this platform were placed headboards 5 feet wide and about 6 feet high. After covering the platform and headboards with paper the bulking was begun by laying the two outer rows, placing the butts of the hands even with the edges of the platform and allowing the tips of the leaves to point to the center. Then another row was laid on each side allowing the butts or heads to rest two-thirds of the length of the leaf from the butts of the first row, keeping the tips pointing to the center. A third row was then made on each side in the same manner. This made six rows across the width of the platform, or sufficient to cover the floor. The second tier was laid in the same manner, and this process was continued until all of the tobacco was bulked. The top of the bulk was covered first with cotton blankets and then with rubber blankets. The tobacco remained in the bulk until November 12, when the temperature began to fall. It was taken down, well shaken, and rebulked, building the new bulk as the old one was taken down. In rebulking, the two top layers were taken off and placed in cases. Then the tobacco was taken from the old bulk, layer by layer, and the new bulk built. When about half of the bulk had been turned, the two layers that had been placed in cases were laid upon the new bulk and the cases refilled with warm tobacco from the middle of the old bulk and set aside until the remainder of the old bulk had been packed on the new, when the tobacco in the cases was used to complete the new bulk. The blankets were replaced to keep the top of the bulk from drying out. In this way what was the inside of the old bulk became the outside of the new, and what was the outside of the old bulk became the inside of the new. By following this method every part of the bulk received the same degree of fermentation.

The following table gives the temperature of the bulk during fermentation. Three thermometers were used, designated in the table as *A*, *B*, and *C*. These were placed in different parts of the bulk—*A* at the bottom, *B* in the center, and *C* at the top of the bulk.

*Temperature of the bulk during fermentation.*

| Date. | Thermometer— | | | Date. | Thermometer— | | |
|---|---|---|---|---|---|---|---|
| | A. | B. | C. | | A. | B. | C. |
| 1904. | °*C.* | °*C.* | °*C.* | 1904. | °*C.* | °*C.* | °*C.* |
| Oct. 22 | 38 | 35 | 35 | Nov. 15 | 28 | 28 | 30 |
| 23 | 40 | 35 | 35 | 16 | 28 | 28 | 30 |
| 24 | 44 | 36 | 35 | 17 | 28 | 28 | 32 |
| 25 | 48 | 36 | 36 | 18 | 29 | 29 | 36 |
| 26 | 49 | 38 | 36 | 19 | 30 | 30 | 40 |
| 27 | 40 | 40 | 36 | 20 | 31 | 32 | 43 |
| 28 | 45 | 41 | 37 | 21 | 34 | 34 | 44 |
| 29 | 45 | 41 | 38 | 22 | 38 | 37 | 44 |
| 30 | 44 | 38 | 38 | 23 | 40 | 38 | 45 |
| 31 | 44 | 38 | 38 | 24 | 42 | 39 | 45 |
| Nov. 1 | 50 | 39 | 39 | 25 | 44 | 40 | 45 |
| 2 | 50 | 41 | 40 | 26 | 44 | 41 | 45 |
| 3 | 50 | 41 | 40 | 27 | 43 | 41 | 45 |
| 4 | 50 | 41 | 40 | 28 | 43 | 41 | 45 |
| 5 | 50 | 42 | 40 | 29 | 43 | 41 | 44 |
| 6 | 51 | 43 | 41 | 30 | 42 | 41 | 43 |
| 7 | 50 | 44 | 41 | Dec. 1 | 42 | 40 | 42 |
| 8 | 50 | 43 | 41 | 2 | 42 | 40 | 42 |
| 9 | 50 | 43 | 40 | 3 | 41 | 40 | 42 |
| 10 | 48 | 42 | 41 | 4 | 41 | 40 | 42 |
| 11 | 46 | 41 | 41 | 5 [a] | 40 | 40 | 41 |
| 12 [a] | 44 | 40 | 41 | | | | |

[a] Bulk turned.

The first readings were taken on October 22, when temperatures of 38°, 35°, and 35° C. were recorded for *A*, *B*, and *C*, respectively. From these points the temperatures rose gradually, but not constantly, until November 9, being on that date 50°, 43°, and 40° C. From this point a decided decline began in the case of thermometers *A* and *B*, the reading for *C* remaining practically stationary. The decreased temperature indicating that the maximum fermentation had taken place, the tobacco was rebulked November 12, being sprayed slightly to replace the moisture lost during the first bulking. The temperature again rose, but the maximum recorded, 45° C., reached November 23, was 6 degrees lower than the maximum recorded for the first bulking. The temperature again declined in all three thermometers after November 28, touching 40 degrees on December 5. At this time the Texas tobacco was taken from the bulk and the Alabama tobacco rebulked and left in this condition to age, no further record being kept of the temperature, as all danger from excessive fermentation had past.

## GRADING AND BALING.

After the tobacco had been thoroly fermented it was assorted into three grades, namely, heavy, flimsy, and broken. The first two grades represented perfect leaves, the only difference being that those classed as heavy filler contained more body than those placed in the flimsy grade. The broken filler consisted of imperfect leaves from both the heavy and light grades, which, because of this condition, would not command as high a price as the other two grades. These grades were again divided, according to the length of the leaf, as follows: The first grade contained all leaves 16 inches long, the second 14 inches, and the third 12 inches. In this classification the 14-inch and 16-inch lengths represent the most desirable leaf.

After the tobacco had been graded and sized it was tied into hands containing from forty to fifty leaves, according to the length of the leaf. Four of these hands of equal length were tied together to form a carrot (see Pl. II, fig. 1), the heads being even and the tobacco wrapt from head to tip with Cuban bast. The carrots weighed from 1 pound to 1¼ pounds, according to the size of the leaf, texture, etc. As soon as a sufficient number of carrots were made they were packed 80 in a bale (see Pl. II, fig. 2) made of yaguas bark, this being the trade package for all southern-grown filler tobacco. The bales were then stacked in piles 5 bales high and kept in a warm room to allow the leaf to undergo the process of aging. Each week the position of the bales was changed until the tobacco had become thoroly and evenly seasoned.

## YIELD AND COST OF PRODUCTION.

The 3 acres cultivated in 1904 yielded, in air-cured tobacco, 1,380 pounds, or 460 pounds to the acre, but owing to the unfavorable climatic conditions during a portion of the growing season some of the tobacco fired and after curing was found to be worthless. This along with the pole-sweat tobacco reduced the yield of commercial leaf to 1,001 pounds, or 334 pounds per acre. The total cost of production was $237.36, or 23.7 cents a pound.

The following statement gives in detail the actual expenses incurred by the Department in the production of Cuban seed filler leaf tobacco in the Alabama experiment of 1904:

*Cost of production.*

| | |
|---|---|
| Plant bed: | |
| Labor, 100 hours at 7½ cents | $7.50 |
| Cheese cloth, 280 yards at 4 cents ($11.20), good for 2 years | 5.60 |
| Nails, 3 pounds, at 3 cents | .09 |
| | 13.19 |
| Preparing land: | |
| Hire of one-horse plow and mule | 2.35 |
| Labor, plowing, 75 hours at 7½ cents | 5.62 |
| Cotton-seed meal, ¾ ton at $25 per ton | 18.75 |
| Cotton-seed hulls, ¾ ton at $11 per ton | 8.25 |
| Horn for distributing meal | .50 |
| Labor, distributing fertilizer at 7½ cents per hour | .75 |
| Labor, team and driver, 10 hours at 30 cents per hour | 3.00 |
| | 39.22 |
| Transplanting: | |
| Labor, 240 hours at 7½ cents per hour | 18.00 |
| Labor, team and driver, 47 hours at 30 cents per hour | 14.10 |
| Tin buckets, 2 at 20 cents each | .40 |
| | 32.50 |
| Field culture: | |
| Labor, hoeing, 40 hours at 5 cents per hour | 2.00 |
| Labor, plowing, 160 hours at 7½ cents per hour | 12.00 |
| Paris green, 5 pounds at 25 cents per pound | 1.25 |
| Hoes, 2 at 80 cents each | 1.60 |
| Corn meal, 1½ bushels at $1 per bushel | 1.50 |
| | 18.35 |
| Suckering and harvesting: | |
| Labor, 300 hours at 7½ cents per hour | 22.50 |
| Labor, team and driver, 65 hours at 30 cents per hour | 19.50 |
| | 42.00 |

Curing and stripping:

| | |
|---|---|
| Labor, 310 hours at 5 cents per hour | $15.50 |
| Labor, team and driver, 10 hours at 30 cents per hour | 3.00 |
| Packing cases, 4 at 50 cents each | 2.00 |
| Wrapping paper, 10 pounds at 5 cents per pound | .50 |
| | 21.00 |

Other expenses:

| | |
|---|---|
| Rent of land, 3 acres at $3 per acre | 9.00 |
| Lumber for barn, 2 loads at $1 per load | 2.00 |
| Nails, 10 pounds at 3 cents per pound | .30 |
| Laths, 1,500 at $2 per M | 3.00 |
| Labor, 30 hours at 7½ cents per hour | 2.25 |
| Labor, team and driver, 13 hours at 30 cents per hour | 4.50 |
| Fermenting 1,001 pounds of tobacco at 5 cents per pound | 50.05 |
| | 71.10 |

*Recapitulation of expenditures.*

| Item. | Total cost. | Cost per pound on 1,001 pounds. |
|---|---|---|
| | *Dollars.* | *Cents.* |
| Seed bed | 13.19 | 1.3 |
| Preparing land | 39.22 | 3.9 |
| Transplanting | 32.50 | 3.3 |
| Field culture | 18.35 | 1.8 |
| Suckering and harvesting | 42.00 | 4.2 |
| Curing and stripping | 21.00 | 2.1 |
| Other expenses | 71.10 | 7.1 |
| Total | 237.36 | [a] 23.7 |

[a] For the expense of growing tobacco where the farmers themselves undertook the work, see tables on pp. 30 and 31.

## RESULTS OF THE SALE OF THE 1903 CROP.

In order to ascertain the opinion of the trade as to the qualities and commercial value of the tobacco grown in Alabama, and to determine the possibilities of establishing its production upon a commercial scale, the Bureau deemed it advisable to place the crop of 1903 upon the market. Arrangements were made with Mr. Herman G. Vetterlein, of Philadelphia, to undertake the sale of this tobacco. In the fall of 1904 the Department issued a catalog showing the number of bales of the various grades of tobacco in its possession, and this catalog, together with samples of the leaf,[a] was widely distributed. The Department had no interest in the sale, all money received, less the broker's commission of $1 per bale, being turned over to the owner of the tobacco at Marion.

Judging from letters received by the Department from various firms purchasing the tobacco, it seems to have given satisfaction,

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[a] The Department reserved 50 per cent of the crop to be distributed as free samples to the trade.

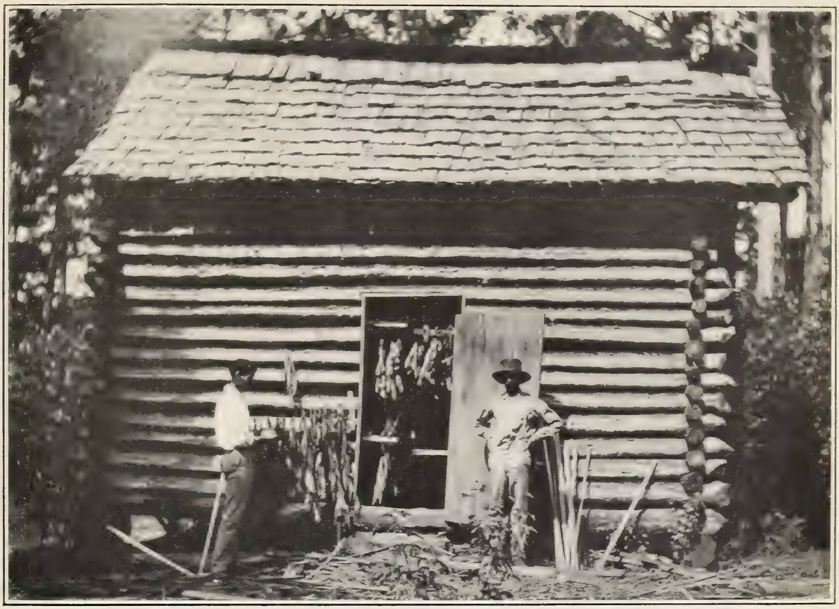

FIG. 1.—TYPE OF BUILDING NOW USED FOR CURING TOBACCO IN ALABAMA.

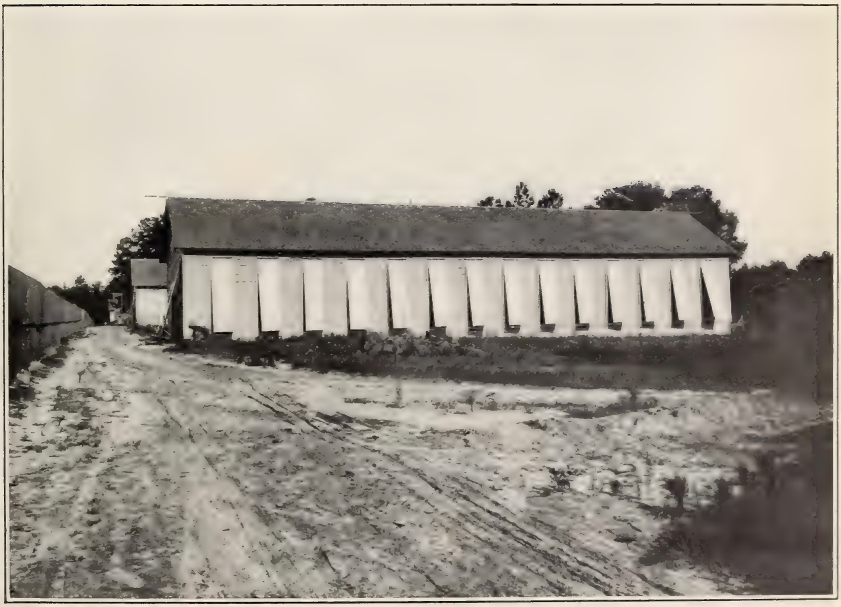

FIG. 2.—MODERN TOBACCO BARN: TYPE OF BUILDING THAT SHOULD BE USED IN ALABAMA.

altho some complain that it is not as aromatic nor as smooth as the Cuban leaf. In nearly every case the manufacturers admit that it is one of the best domestic fillers they have ever tested and predict a future for it, if produced at reasonable prices.

The following letter was received from Mr. Vetterlein in regard to the sale of the tobacco:

PHILADELPHIA, PA., *February 23, 1905.*

DEAR SIR: The tobacco grown in Alabama under the supervision of the Bureau of Soils being now sold, I would herewith report that, while there was a very complete and thorough distribution of the catalogues calling the attention of the manufacturers of cigars and dealers in leaf tobacco to the experiments made in the above-mentioned State, the demand for samples to test the merits of this tobacco was not so great as one would expect, and this can only be accounted for by the fact that the manufacturers of cigars are loath to take up anything new or different to what they have been using for fear of injuring their established brands of cigars, the result of years of work and expense. However, various samples and bales have been distributed sufficiently to warrant the statement that the Department has succeeded in growing a superior piece of filler tobacco, part of it being smooth and mellow in taste and flavor and part of it having a trifle more body; but all being very suitable for mixing with Havana or even for using clear. With continued growing and handling it with the natural improvement that one would expect in its continual production, in the end it should find a position in the market where its merits should create a satisfactory demand. To secure this desirable result it will be necessary for the growers to be satisfied with small profits in the beginning, and prices should be made accordingly, so as to invite purchasers.

Inclosed you will find a statement showing how the tobacco grown by your Department has been sold.

With kind regards, I remain,

Yours, truly,

H. G. VETTERLEIN.

*Statement of tobacco grown in Alabama under the supervision of the Bureau of Soils and sold by Herman G. Vetterlein, C. H. Greer crop.*

| | |
|---|---|
| 5 bales, Nos. 38, 39, 40, 41, 42, 351 pounds net, at 30 cents | $105. 30 |
| 1 bale, No. 37, 78 pounds net, at 40 cents | 31. 20 |
| | 136. 50 |
| Commission at $1 per bale | 6. 00 |
| | 130. 50 |

It will be seen from the above statement that this tobacco ranged in price from 30 to 40 cents a pound. The prices were for the finished product, and covered not only the original cost of growing the tobacco and the expense of fermenting, sorting, and packing, but also the shrinkage in weight and other losses incident to these operations.

## DISTRIBUTION OF THE 1904 CROP.

In previous experiments in Alabama the Bureau had conducted its investigations in cooperation with the owners of the land on which the experiment was made, but in 1904, in order to have the entire control of the tobacco produced, the Bureau rented the land and other facilities for producing the crop. As the object of the Bureau was to bring the product to the notice of the trade in as wide a manner as possible and to receive from the cigar manufacturers and dealers in leaf tobacco their opinions as to the quality of the tobacco grown in Alabama, it was considered abvisable to make a free distribution of the crop. From October 28 to December 4, 1905, samples were sent to more than two hundred of the principal cigar manufacturers and leaf dealers of the country; and from the letters received by the Department the tobacco seems to have given satisfaction. Extracts from letters received from Pretzfeld & Co., of New York, and from Celestine Vega & Co., of Chicago, follow:

[From Pretzfeld & Co.]

Samples of filler tobacco and your favor of October 31 were duly received. Excuse if we did not report sooner on same. We find but slight difference in the merit of the fillers and all of them are good and useful. We consider the sample marked "Alabama" the most pleasant in taste and flavor and the best tobacco.

[From Celestine Vega & Co.]

Alabama filler tobacco: Size, perfect; burn, perfect; taste, pretty good; texture, very good; curing, very good; packing, very good; value, high.

## COOPERATIVE EXPERIMENTS OF 1905.

Encouraged by the success of the earlier experiments, the Bureau issued a circular in December, 1904, giving a brief outline of the work accomplished so far and announcing the purpose of the Bureau to cooperate with a limited number of farmers in the growing of a commercial crop during the season of 1905.

In February, 1905, a meeting of farmers interested in the culture of tobacco was held in the court-house at Marion, Perry County, for the purpose of formulating plans to carry on the work. Owing to the inclement weather, a severe ice storm raging on the day set for the meeting, only a few leading farmers attended. Nine of these agreed to undertake the growing of tobacco. The total acreage promised was 12½ acres, and the farms were well distributed over the county from near Marion to points 12 miles away, thus affording the farmers of the county who had the Orangeburg type of soil on their farms the opportunity to watch the progress and practicability of growing Cuban seed filler tobacco in their vicinities. To all the farmers agreeing to cooperate the Bureau of Soils promised to furnish imported Cuban seed and to supervise the production of the crop in all its stages free of charge.

On account of the extremely unfavorable weather conditions during the month of February it was late in the season before the plant beds could be prepared. Some of the beds were made on the banks of small streams by cutting off the timber and burning the ground by the drag method, while others were made in gardens or other fertile spots near the house by making a cold frame, as is the common practise in the northern tobacco-producing regions. Six hundred square yards of plant bed were prepared, planted, and covered with cheese cloth. The covering hastens the growth of the plants, keeps out all insects, and protects the seedlings from the heavy rains which are common to most sections of the South. The sowing of the beds began on February 24 and continued to March 10, from 1 spoonful to 1½ spoonfuls of seed being sown to every 10 square yards of bed. From these beds a fair stand of plants was obtained, the beds being fertilized with cotton-seed meal and nitrate of soda. On only one bed was the stand poor, and this was due to a mistake in selecting the seed-bed soil. This bed was badly infested with nut grass, which being stimulated by the fertilizer outgrew and to a large extent uprooted many of the young plants, while more were lost in the process of weeding.

The various fields were prepared as soon after the winter rains as the soil was in proper condition for plowing. The land was broken broadcast with ordinary turning plows, some of the farmers on the stiffer soils using a two-horse and those on the lighter soil a one-horse plow. In all cases the land was broken deep at this first plowing. Whenever stable manure was used as fertilizer, it was applied to the fields before they were plowed.

Early in April the fields were laid off with a shovel plow in rows 3 feet apart and the fertilizer—1,200 pounds of cotton-seed meal and 200 pounds of sulfate of potash to the acre—distributed in these furrows. This was thoroly incorporated in the soil with a "scooter" plow, after which two turn furrows were thrown together, making a low ridge or bed. The fields were left in this condition until the time of transplanting, when these beds were mellowed by running a small straight-tooth harrow over them. The 1,200 pounds of cotton-seed meal and 200 pounds of sulfate of potash applied, or the stable manure and potash, with or without the addition of cotton-seed meal, were mixt in such proportion as to supply about 100 pounds of nitrogen, 24 pounds of phosphoric acid, and 96 pounds of potash per acre.

Several days before transplanting the tobacco to the fields the cloth was removed from all of the plant beds for the purpose of accustoming the tender plants to the direct heat of the sun. Transplanting was begun April 15 and finished on May 15. In pulling the plants from the bed the farmers were cautioned to be careful to see that the root systems were not injured, especially the tap root. To guard against such damage, the seed bed was saturated with water. After pulling the plants they were placed in flat boxes or baskets to facilitate transportation to the field. In order to have the crops transplanted early enough in the season, it was necessary to perform some of this work during dry weather, altho whenever it rained or was cloudy the setting of plants was pushed vigorously. During the dry weather holes from 12 to 14 inches apart were dug with a hoe and about half a pint of water was poured into the holes, the plants being set in the moistened soil. Dry soil was then drawn around the plant, which prevented it from being scalded or the soil around it baking. When the transplanting was done during wet weather it was not necessary to dig holes with the hoe, and a small hole was made with a dibble or peg, into which the root of the plant was placed and the soil prest tightly around it.

About a week after transplanting, by which time the plants had taken root, the soil around them was lightly broken with a hoe. This was done as often as necessary, either to break the crust which would form on the surface of the soil after each rain or to remove weeds or grass from around the tobacco. Shortly after the hoeing, cultivation was begun with small sweep plows, plowing three furrows to the row, which pulverized the soil on both sides of the tobacco as well as in the middle of the rows. As the size of the tobacco increased larger sweep plows were used for cultivating, and this was continued every week, or as soon after each rain as possible, until the tobacco had obtained its growth and was ready to be topt. As far as possible a mulch was kept on the surface of the soil at all times to prevent the rapid evaporation of moisture, as well as to check the growth of weeds and grasses.

The usual insect enemies of tobacco were encountered, such as cutworms, bud worms, and hornworms. These, with the exception of the hornworm, were kept in check by an application of paris green mixt either with corn meal or fine sifted sand. For the hornworm a solution of paris green was used, applied with a knapsack spray pump.[a] The crops were poisoned as often as necessary, and in every case the tobacco was poisoned for hornworms prior to cutting and placing it in the barns. If this precaution were omitted the worms would cause considerable damage to the tobacco while in the process of curing, at which time it would be almost impossible to check their ravages.

The tobacco was ready for topping as soon as the seed buds appeared. These were taken out along with a few of the upper leaves. After topping the tobacco, suckers appeared and were removed. Cuban tobacco has a tendency to sucker freely, and it was found necessary to break off the suckers three times between the time the crops were topt and their ripening.

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[a] A mixture of 1 pound of Paris green and 1 pound of lime to 125 gallons of water was used, as recommended by the Bureau of Entomology.

Harvesting was begun the middle of June. Care was taken not to allow the tobacco to become overripe, but to cut it just as it reached the right condition. An ordinary corn knife was used, the stalk being severed about 2 inches above the ground. It was then allowed to lie on the ground long enough to wilt—about thirty minutes during the heat of the day, or a little longer when cut early in the morning or late in the evening—when it was carried on stretchers or in a wagon to the barns and speared upon laths 4 feet long, from 8 to 12 stalks to each lath. These were hung on tiers, there being sufficient space between the tiers to allow a free circulation of air.

There are no tobacco barns in this section of the country, so, as the growers did not feel justified in going to the expense of building until the industry had past the experimental stage, use was made of available buildings already upon the farms. Gin houses and corncribs were the buildings generally used. (See Pl. III, figs. 1 and 2.) These were fitted with tier poles and made as serviceable as practicable at small expense. These accommodations were at best inadequate and made it very difficult to regulate moisture conditions, especially in a climate where the humidity is so great during the curing season. During rainy periods it was necessary to place fires in the barns, the tobacco being removed from the lower tiers immediately over the fires. Planks were also placed on the lower tiers over the fires to break the volume of heat and to disseminate it to different parts of the building. Firing was kept up regularly during the rainy weather, the barns being tightly closed to prevent the entrance of moisture from outside. During dry weather the barns were closed during the day and opened at night to prevent too rapid curing or "haying" of the tobacco. Considering the type of buildings in which the crops were cured and the poor facilities they offered, a very satisfactory cure was obtained by most of the growers.

As soon as the tobacco had cured, which it did in about five weeks from the time of hanging it in the barns, it was taken from the tier poles, the leaves stript off the stalks, and sorted into three grades consisting, respectively, of the top, middle, and sand leaves. These were tied separately, from thirty to forty leaves to each hand, and afterwards packed in boxes and delivered to the warehouse at Marion for fermentation. The tobacco was bulked on September 9 and allowed to remain in bulk until September 18, when it was taken down and rebulked. The temperature was not recorded during the first bulking, but when taken down on October 3 the temperature of the bulk had reached 105° F. On this date the tobacco was packed in cases for shipment to Quincy, Fla., as the entire crop had been purchased from the farmers at 15 cents per pound by a firm of leaf dealers and packers of that city, who finished the fermentation and assorting in their own warehouse.

The yield from 12½ acres, not including unmerchantable tobacco, was 4,457 pounds, or 356½ pounds to the acre. The loss in weight in handling and curing was 293 pounds, and the average weight of the tobacco as harvested was 380 pounds per acre. The largest yield obtained by any individual grower was 848 pounds per acre and the lowest 260 pounds per acre, green weight.

*Actual expenses incurred by the grower securing the largest yield.*

[Area planted, 1½ acres.]

| | |
|---|---|
| Plant bed: | |
| Stable manure, 13 loads, at 25 cents per load | $3.25 |
| Labor, ox and wagon, 1 day | 1.50 |
| Cheese cloth, 135 yards, at 3 cents per yard | 4.05 |
| Nitrate of soda, 15 pounds, at 3¼ cents per pound | .50 |
| Labor, 110 hours, at 5 cents per hour | 5.50 |
| | 14.80 |
| Preparing land: | |
| Labor, plowing with two-horse plow, 10 hours, at 20 cents per hour | 2.00 |
| Labor, plowing with one-horse plow, 15 hours, at 10 cents per hour | 1.50 |
| Labor, distributing fertilizer, horse and wagon, 10 hours, at 10 cents per hour | 1.00 |
| Stable manure, 20 loads, at 25 cents per load | 5.00 |
| Cotton-seed meal, 500 pounds, at $1.10 per hundred | 5.50 |
| Sulfate of potash, 200 pounds, at $3.50 per hundred | 7.00 |
| | 22.00 |
| Transplanting and cultivating: | |
| Labor, 56 hours, at 5 cents per hour | 2.80 |
| Labor, hoeing, 30 hours, at 4 cents per hour | 1.20 |
| Labor, plowing, one-horse plow, 17 hours, at 10 cents per hour | 1.70 |
| | 5.70 |
| Poisoning: | |
| Labor, 12 hours, at 5 cents per hour | .60 |
| Paris green, 3 pounds, at 25 cents per pound | .75 |
| | 1.35 |
| Suckering and topping: | |
| Labor, 40 hours, at 5 cents per hour | 2.00 |
| Harvesting and stripping: | |
| Labor, 125 hours, at 5 cents per hour | 6.25 |
| Labor, 230 hours, at 3 cents per hour | 6.90 |
| | 13.15 |
| Cartage and miscellaneous expenses: | |
| Labor, team and driver, 10 hours, at 30 cents per hour | 3.00 |
| Boxes, 5, at 25 cents each | 1.25 |
| Rent of barn and implements, 2 months, at $2.50 | 5.00 |
| Lath, 2,500, at $2.50 per thousand | 6.25 |
| Rent of land, 1½ acres, at $1.50 per acre | 2.25 |
| | 17.75 |

| | |
|---|---|
| Total operating expenses | $76. 75 |
| Value of 1,272 pounds of tobacco, at 15 cents per pound | 190. 80 |
| Profit | 114. 05 |
| Cost of growing tobacco, per pound | . 06 |

*Actual expenses incurred by the grower securing the smallest yield.*

[Area planted, 1 acre.]

| | | |
|---|---|---|
| Plant bed: | | |
| Stable manure, 1 load, at 25 cents | $0. 25 | |
| Nitrate of soda, 10 pounds, at 3¼ cents per pound | . 33 | |
| Cheese cloth, 40 yards, at 3 cents per yard | 1. 20 | |
| Labor, 50 hours, at 5 cents per hour | 2. 50 | |
| | 4. 28 | |
| Preparing soil: | | |
| Labor, plowing, one-horse plow, 20 hours, at 10 cents per hour | 2. 00 | |
| Labor, distributing fertilizer, horse and wagon, 10 hours, at 20 cents per hour | 2. 00 | |
| Cotton-seed meal, 500 pounds, at $1.10 per hundred | 5. 50 | |
| Sulfate of potash, 200 pounds, at $3.50 per hundred | 7. 00 | |
| Stable manure, 10 loads, at 25 cents per load | 2. 50 | |
| | 19. 00 | |
| Transplanting and cultivating: | | |
| Labor, 30 hours, at 5 cents per hour | 1. 50 | |
| Labor, hoeing, 10 hours, at 5 cents per hour | . 50 | |
| Labor, plowing, 13 hours, at 10 cents per hour | 1. 30 | |
| | 3. 30 | |
| Poisoning: | | |
| Labor, 10 hours, at 5 cents per hour | . 50 | |
| Paris green, 2 pounds, at 25 cents | . 50 | |
| | 1. 00 | |
| Suckering and topping: | | |
| Labor, 30 hours, at 5 cents per hour | 1. 50 | |
| Harvesting and shipping: | | |
| Labor, 150 hours, at 5 cents per hour | 7. 50 | |
| Cartage and miscellaneous expenses: | | |
| Labor, cartage, and boxes | 2. 50 | |
| Rent of farm and implements | 3. 00 | |
| Rent of 1 acre of land | 2. 00 | |
| Tobacco sticks, 1,100, at $2.50 per thousand | 2. 75 | |
| | 10. 25 | |
| Value of 379 pounds tobacco at 15 cents per pound | 56. 85 | |
| Operating expenses | 46. 83 | |
| Profit over operating expenses | 10. 02 | |
| Cost of growing tobacco, per pound | . 12 | |

The marked difference in the yield and cost of these two crops was to a slight extent due to the climatic conditions under which they were grown. The soil in both fields was the same, the composition and the quantities of fertilizers applied were the same, but great differences were noticed in the preparation of the soil. The grower obtaining the largest yield plowed his land with a two-horse plow, breaking the soil deeper than the other, who broke his land with a one-horse plow. This difference in preparing the land proved, under the climatic conditions of the season of 1905, to be a very important factor in determining the yield and profit of the crops. During a part of the growing season this section of the country suffered from the lack of rain, and all crops planted on land that had received only a shallow plowing in the spring began firing, while those crops where the soil had been plowed deeper and afterwards kept in a good state of cultivation continued to grow and keep green. The difference illustrates the advantage of such cultivation as will conserve soil moisture.

This object lesson in tillage should be well imprest on every farmer who wishes to obtain the best results from a crop of tobacco. The land should be plowed deep every year, and if the plowing is done in the fall subsoiling is also advisable, especially on the Orangeburg types of soil. The crop should be kept in a high state of cultivation thruout its growth, and as soon after each rain as possible the surface should be stirred to produce a soil mulch. The crop should be hoed by hand whenever necessary. This operation is usually required when the plants are small, at which time a growth of grass or weeds is especially injurious to their development.

## CONCLUSION.

In 1906 the acreage of tobacco in Alabama increased more than 200 per cent, and there seems to be no reason why a profitable industry should not be built up if the farmers will only conduct it along conservative lines and endeavor to produce the type of leaf that is demanded by the trade. Diversified farming must be the future aim of the southern farmers, and the introduction of tobacco in central Alabama will be one more crop added to the staple products of that section of the State.

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